

chapter nine

Technological innovation in DRG-based hospital payment systems across Europe

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9.1 Introduction

Technological innovation in health care is highly valued by patients, clinicians and politicians (Rettig, 1994), as advances in medical technology have greatly improved the ability to prevent, diagnose and treat a large number of diseases and conditions, leading to reduced mortality and better quality of life in many countries (Atella & The TECH Investigators, 2003; Cutler & McClellan, 2001; Cutler, 2007; Tunstall-Pedoe et al. 2000). At the same time, technological innovation is a major driver of increasing health care costs (Weisbrod, 1991; Cutler et al., 1998a; Congressional Budget Office 2008), and policies have been devised with the aim of balancing technological innovation and affordability (Schreyögg et al., 2009).

The hospital payment system is one important factor influencing the implementation of technological innovation in health care (Greenhalgh et al., 2004; Banta, 1983; Torbica & Cappellaro, 2010; Atella & the Tech Investigators, 2003; Cappellaro et al., 2011), especially as many new technologies are first used in the inpatient sector. Ever since the introduction of diagnosis-related group (DRG)-based hospital payment systems, there have been concerns that these systems may not provide the right set of incentives to encourage the desired adoption and use of technological innovations in health care (OTA, 1983; Garrison & Wilensky, 1986; MedPAC, 2001; Shih & Berliner, 2008). Consequently, mechanisms have been developed by most countries using DRG-based hospital payment systems to account for technological innovation in health care (MedPAC, 2003; Clyde et al., 2008; Schreyögg et al., 2009; Henschke et al., 2010).

This chapter aims to (1) clarify the relationship between DRG-based hospital payment systems and technological innovation; and (2) to describe how the 12 countries included in this book attempt to overcome the potential problems for technological innovation associated with DRG-based hospital payment systems. The following section (9.2) provides a theoretical overview of the relationship between technological innovation, hospital costs and quality, in order to explain how DRG-based hospital payment systems can potentially affect the adoption and diffusion of technological innovations. Subsequently, section 9.3 presents a comparative analysis of the analysed countries' policy responses to the problems of encouraging technological innovations and incorporating them formally into DRG-based hospital payment systems. Section 9.4 summarizes the findings and draws some conclusions for European countries regarding how best to deal with technological innovations in the context of DRG-based hospital payment systems.

9.2 Technological innovation and DRG-based hospital payment in theory: Costs, quality and the adequacy of payment

9.2.1 Technological innovation: Costs and quality

Technological innovation is often defined as the practical application and diffusion of ideas or knowledge (Goodman, 2004). In health care, innovations can potentially refer to all categories of medical technology, such as drugs, devices, equipment and supplies, medical and surgical procedures, support systems and organizational and managerial systems (Banta et al., 1978). Technological innovation may be incremental, consisting of small improvements of existing services; or it may comprise radical changes, such as replacing surgical therapy with new medical therapy. Finally, technological innovation may occur as a transfer or adaptation of existing technology from one setting to another, for example the shift of certain procedures from inpatient settings to day care.

When analysing the implications of DRG-based hospital payment systems for the adoption and diffusion of technological innovation in health care, it is essential to consider the effects of technological innovations on hospital costs and quality. Table 9.1 illustrates possible effects of technological innovations on hospital costs: such innovations may increase or decrease capital costs, operating costs or both (OTA, 1983). Yet, the overall effect on hospital costs depends on the interplay of various factors. For example, in large or highly specialized hospitals, an increase in capital costs might be compensated by reductions in operating costs, if capital costs can be distributed among a sufficiently large number of patients. In small or less-specialized hospitals, the effect of the same technological innovation on costs may be different. Furthermore, it is important to bear in mind that technological innovations may be related to costs of all hospital services (for example, the introduction of electronic medical records) or may only affect the costs of treating a small and very specific group of patients (for example, the introduction of drug-eluting stents).

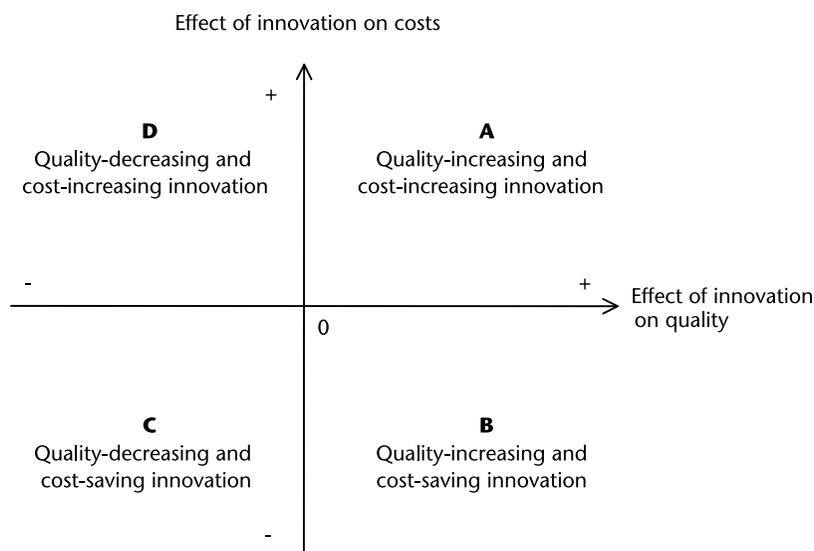
Table 9.1 Possible effects of technological innovation on hospital costs

| <i>Technological innovation</i> | <i>Effect on costs</i> | | |
|---|------------------------|------------------|--------------|
| | <i>capital</i> | <i>operating</i> | <i>total</i> |
| Cost-increasing technology | + | + | + |
| Cost-decreasing technology | - | - | - |
| Capital cost-increasing technology | + | - | +/- |
| Operating cost(s)-increasing technology | - | + | +/- |

Source: OTA, 1983, with modifications.

Quality in health care can be defined as any aspect of health services that benefits patients during the process of treatment or improves health outcome after treatment (see Chapter 8). In theory, the effect of technological innovation on 'quality' can be positive, neutral or negative. Figure 9.1 illustrates different theoretical combinations of costs and quality that can result from the introduction of technological innovations, using a graphical illustration similar to that of the cost-effectiveness plane (Black, 1990). Technological innovations can increase both costs and quality (A), increase quality while decreasing costs (B), decrease both costs and quality (C), or increase costs while decreasing quality (D).

Whether or not the incentives of DRG-based hospital payment systems produce socially desirable effects depends on the specific combination of costs and quality; that is, it depends on the quadrant (A to D) into which the new technology would be classified. Technologies falling into quadrant B would be always desirable, whereas technologies falling into quadrant D should never be


Figure 9.1 Effects of innovation on cost and quality

Source: Adapted from Black, 1990.

adopted. For technologies falling into quadrants A and C, things are more complicated (Cutler & McClellan, 2001). For quadrant A, the country-specific willingness to pay for a given increase in quality determines whether these technological innovations should be used in hospitals. Conversely, for technologies falling into quadrant C, it depends on the extent to which countries are willing to forego quality in exchange for a decrease in costs.

However, the effects (especially long-term effects) of technological innovation on quality (and on costs) are often difficult to identify at the time, when innovations are first introduced into hospital practice (Mowatt et al., 1997). In fact, a variety of technologies have been found to be ineffective or even harmful after having been widely adopted and used (Goodman, 2004). Consequently, policy-makers face considerable uncertainty when making decisions about technological innovations.

9.2.2 DRG-based hospital payment systems: Incentives against technological innovation?

Under DRG-based hospital payment systems, clinicians are free to decide on the exact set of technologies that they want to employ when treating a given patient. However, as outlined in Chapter 6, DRG-based hospital payment systems provide a specific set of incentives to hospitals that are likely to have an effect on shaping the clinicians' decisions. This subsection investigates how these incentives may influence the use of technological innovations in hospitals. Under the most basic DRG-based hospital payment system, introduced in Chapter 6, hospitals are paid a predetermined fixed payment rate per case. Consequently, hospitals are encouraged to keep their average costs below the payment rate in order to avoid making a loss. Thus, the two dominant incentives of a basic DRG-based hospital payment system encourage hospitals to (1) reduce costs per admission, and (2) increase the number of admissions (OTA, 1983).

The effects of these incentives on the hospitals' willingness to adopt and to use technological innovations are summarized in Table 9.2. Hospitals are likely to invest in technological innovations that reduce total costs per admission. They may purchase new diagnostic equipment or electronic drug interaction monitoring systems if these can be shown to reduce costs per stay – for example, by reducing length of stay. In cases in which technological innovations are cost neutral, or in which increases in one area can be compensated by decreasing costs in another area, DRG-based hospital payment systems should have no effect on the introduction of technological innovations. Furthermore, as technological innovation often increases capital costs, DRG-based hospital payment systems might encourage the specialization of hospitals (if separate funding for capital costs is unavailable), concentrating the adoption of technological innovations in centres with sufficiently large numbers of patients. In addition, as hospitals bear the financial risk of average costs rising above the payment rate, hospitals are likely to make use of economic evaluations before introducing certain technological innovations.

As far as many cost-decreasing, cost-neutral or cost-increasing but quality-decreasing technological innovations are concerned (quadrants B to D in

Table 9.2 Incentives of DRG-based hospital payment systems and effects related to technological innovation

| <i>Main incentives</i> | <i>Effects related to technological innovation</i> |
|----------------------------------|--|
| 1. Reduce costs per admission | <ul style="list-style-type: none"> • Promoting the use of cost-decreasing technological innovations • Encouraging the concentration of capital cost-increasing innovations in fewer institutions, leading to specialization of hospitals for certain technologies • No effect on technological innovations that are cost neutral • Discouraging the introduction of cost-increasing technologies • Encouraging HTAs before introduction of new technologies |
| 2. Increase number of admissions | <ul style="list-style-type: none"> • Encouraging the use of technologies promoting hospital reputation • Promoting the use of technological innovations valued by patients/admitting physicians |

Source: Based on OTA, 1983.

Figure 9.1), DRG-based hospital payment provides incentives that are likely to be in line with societal objectives: they encourage adoption of technological innovations in quadrant B and C, and inhibit technological innovation in quadrant D. However, economic evaluations and country-specific value-judgements are required in cases in which cost-decreasing technological innovations are accompanied by decreases in quality (quadrant C), as it should be determined whether the decrease in quality outweighs the reduction in costs (Drummond et al., 2005).

Problems with DRG-based hospital payment occur when technological innovations improve quality but are associated with increased costs per admission (quadrant A in Figure 9.1). In most countries, DRG-based payment rates are at least remotely related to the average costs of treating cases in other hospitals in the past (see Chapter 5). When technological innovations are introduced, hospitals are paid according to historical cost patterns that do not reflect the (potentially) higher costs of using technological innovations. Consequently, disincentives exist for hospitals to adopt and use cost-increasing technological innovations until the payment system is updated to account for their extra costs. Patient access to quality-increasing technological innovations that also increase costs could be delayed because, in general, it takes some time for enough information regarding the costs of using a technological innovation in routine practice to be generated.

In some cases, the disincentive for using technological innovations under DRG-based hospital payment systems might be counterbalanced by the second kind of incentive (Table 9.2), which is to increase the number of admissions. In competitive environments, and if certain technological innovations are thought to improve hospital reputation or to stimulate admissions by physicians, hospitals are likely to react by offering these services (OTA, 1983). Of course,

particular design features of each country's DRG system and its DRG-based hospital payment system (see Chapter 6 of this volume) are likely to modify the strength of the basic incentives of these systems. For example, several countries (such as France, Germany, Ireland, Poland, and Spain (Catalonia)) provide additional funding for capital costs, thus exempting a significant proportion of hospital costs (particularly relevant in the context of innovations that increase capital costs) from the incentives of DRG-based hospital payment. Similarly, the availability of funding from sources other than the DRG-based hospital payment system may modify the incentives of DRG-based hospital payment systems. For example, hospitals receiving extra funding for teaching or research are more likely to be in a better position to adopt technological innovations.

Yet, as evidenced by the existence of specific payment instruments for technological innovations in most countries across Europe (see section 9.3), DRG-based hospital payment systems alone seem to be perceived as providing insufficient incentives for the desired introduction of technological innovations that increase quality but also increase cost.

9.3 Technological innovation and DRG-based hospital payment in practice: 12 European countries in comparison

As illustrated in the country-specific studies in the Part Two of this volume, and as shown by Scheller-Kreinsen et al. (2011) DRG-based hospital payment systems in most countries are updated at regular intervals. These long-term mechanisms ensure that technological innovations are eventually formally incorporated into the DRG-based hospital payment system, either through updates of the DRG system (see Chapter 4), or through updates of the payment rate (see Chapter 6). In addition, almost all countries have developed certain short-term payment instruments that encourage the use of quality-increasing technological innovations that also increase costs, within the time period during which the DRG-based hospital payment system does not yet account for the technological innovation.

Figure 9.2 illustrates the short-term payment instruments and long-term updating mechanisms used to encourage and incorporate technological innovation in the DRG-based hospital payment system. On the left, the figure shows the short-term payment instruments used to encourage the use of quality-increasing technological innovations that also increase costs. These can be completely outside the system (extreme left) or can be associated to the DRG-based hospital payment system (in the middle). On the right, the figure presents mechanisms to incorporate technological change into the systems, either by updating the DRG system – that is, the patient classification system (PCS) – or by adjusting the payment rate. When updating the PCS, several options exist: (1) cases can be reassigned to different DRGs, (2) existing DRGs can be split, and (3) new DRGs can be created when necessary.

A common challenge for policy-makers when devising payment policies is to find the right balance between two conflicting goals (Schreyögg et al., 2009). On the one hand, they need to provide sufficient incentives for hospitals to make use of quality-increasing technological innovations that also increase

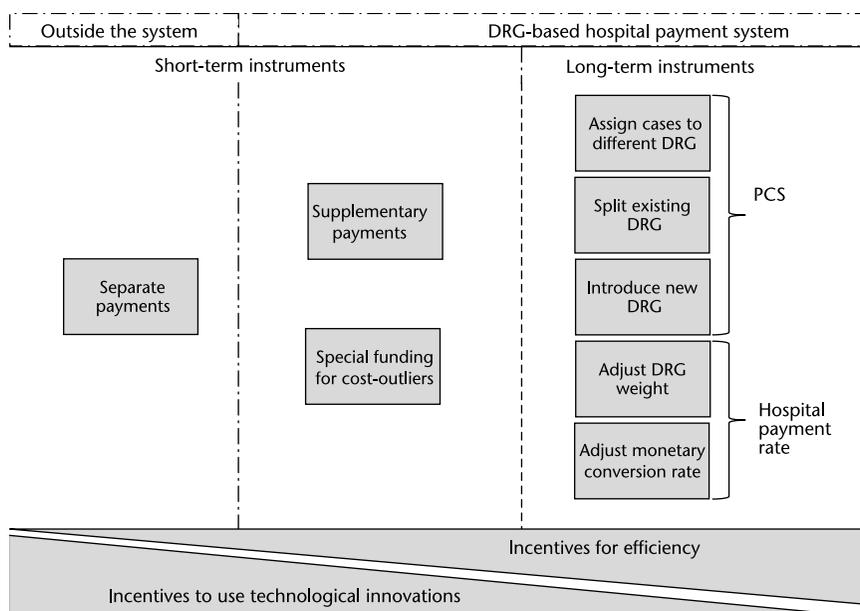


Figure 9.2 Short-term payment instruments and long-term updating mechanisms

costs, in order to assure patient access. On the other hand, they need to keep expenditure for technological innovations under control. If short-term instruments provide additional payments for selected technological innovations, these payments introduce incentives that may distort clinical decision-making and can lead to inefficiencies related to over-provision of these services and escalating health care costs (MedPAC, 2001). These conflicting incentives are illustrated by the bars at the bottom of Figure 9.2. Specific incentives to use technological innovations should decrease as technologies become more formally incorporated into the system (although exceptions are conceivable, as discussed later). Conversely, incentives for providers to make efficient use of resources increase once the use of technological innovations is no longer encouraged through specific payment incentives.

9.3.1 Short-term instruments across Europe to encourage the use of technological innovation

In the countries analysed in this book, three different short-term instruments are employed to encourage the use of quality-increasing technological innovations that also increase costs: (1) separate payments, (2) supplementary payments and (3) special funding for cost-outliers. Table 9.3 shows that these three types of short-term instruments can be represented in different forms.

Separate payments can take two forms: (1) fee-for-service payment, negotiated nationally or locally, as is used in Germany (see Box 9.1); or (2) retrospective reimbursement of hospital-reported total costs, as is used by some county

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Table 9.3 Instruments to encourage the use of technological innovation and types of associated payments

| <i>Instrument</i> | <i>Type of payment</i> |
|-----------------------------------|--|
| <i>Outside DRG system</i> | |
| Separate payments | <ul style="list-style-type: none">• fee-for-service (based on weighted costs or negotiated payment)• retrospective reimbursement of reported costs per case |
| <i>Inside DRG system</i> | |
| Supplementary payments | <ul style="list-style-type: none">• fee-for-service• retrospective reimbursement of costs above standard rate |
| Special funding for cost-outliers | <ul style="list-style-type: none">• payment of weighted costs• retrospective reimbursement of costs above a statistically determined threshold• fixed payments (based on weighted costs or negotiated payment)• payment of weighted costs |

councils in Sweden. Both payment instruments are designed to encourage the use of technological innovations when information regarding associated costs and effects is still relatively scarce. Separate payments do not necessarily require procedure codes to have been assigned to procedures, or drugs to be entered in specific lists. The associated flexibility allows some countries, such as France, to make decisions at the level of the individual patient; for example, whether or not to pay for experimental cancer drugs (see Chapter 13). Consequently, access to new therapies in France (particularly in terms of cancer treatment) remains one of the most generous in Europe (de Pourville, 2009). However, the disadvantages of extensively using a system of separate payments have also been experienced in France, where expenditure on new drugs has rocketed (Cour de Comptes, 2009).

Box 9.1 Separate payment to German hospitals under NUB regulations

In Germany, the New Diagnostic and Treatment Methods Regulation (NUB) was introduced as part of the 2005 Hospital Remuneration Act (KHEntgG). It provides extrabudgetary funding in the form of negotiated fee-for-service payments to selected hospitals using technological innovations. Hospitals wishing to be reimbursed via NUBs for their use of technological innovations must take several steps before being reimbursed. First, hospitals must apply – with a description of the new technology and of associated costs – to the Institute for the Hospital Remuneration System (InEK), which is responsible for managing the German diagnosis-related groups (G-DRG) system. If the application is accepted, individual providers must successfully negotiate with the sickness funds concerning the size of the payments to be made. Finally, each hospital must conclude a contractual

agreement with the sickness funds to receive NUB reimbursement for its use of the technology. Negotiated NUB payments are valid for only one year and hospitals need to reapply to the InEK if they want to continue to use a technology in subsequent years. Since the introduction of this approach in 2005, it has been shown that acceptance for NUB reimbursement often represents the first step in the process of incorporating new technologies into the DRG system (Henschke et al., 2010).

Source: Henschke et al., 2010.

In contrast to separate payments, supplementary payments and cost-outlier funding are relevant for technological innovations, but are also used to improve the general coherence of the DRG system by excluding certain high-cost technologies or high-cost patients and reimbursing them separately (see Chapter 4 and Chapter 6). Both instruments take a specific DRG payment rate as a starting point and justify additional payments in terms of substantial differences between incurred costs and standard payment rates.

Supplementary payments are made on top of the 'standard' DRG payment rate if specific technologies (including new and innovative ones) are applied. The amount to be paid on top of the standard rate can be negotiated or can take the form of retrospective reimbursement of reported costs (per case) above the standard rate of individual providers. In some countries costs are weighted across providers before being paid; that is, average costs per patient category are calculated and reimbursed ('payment of weighted costs'). The necessary administrative processes for establishing a relationship between a procedure (a technological innovation) and a DRG require some time, which may contribute to slowing down the adoption of technological innovations by hospitals. In some cases, a procedure code needs to be assigned to a technological innovation before supplementary payments can be made, thus prolonging the process of providing reimbursement for technological innovations.

In countries in which special funding for cost-outliers is available, the way technologies (including new and innovative ones) influence homogeneity of resource use of patients within DRGs determines whether special funding is made available on top of standard payment rates. Cost-outlier funding builds on detailed retrospective statistical analysis of cost data. Different variants of this instrument exist (see Table 9.3). In addition, many countries provide extra payments for length-of-stay outliers (see Chapter 6) but these instruments are not particularly relevant to technological innovation, as technological innovation may contribute to a reduction in the length of stay, for example, when new, minimally invasive surgical procedures lead to faster patient recovery and discharge (Simpson et al., 2005).

Table 9.4 presents the distribution of the outlined short-term payment instruments across the 12 countries. Separate payments are the most frequently used payment instrument. Surprisingly, cost-outlier funding for cost-increasing technological innovation is used only in Estonia, Finland and some Swedish county councils. Some countries with DRG-based budget-allocation systems (such as Austria and Portugal) do not make use of any short-term payment instruments.

Table 9.4 The application of short-term reimbursement instruments in 11 European countries (plus Catalonia)

| | <i>Instruments used to provide extra payments for technological innovations</i> | | |
|------------------------|---|--------------------------------------|-----------------------------|
| | <i>Separate payments</i> | <i>Supplementary payments</i> | <i>Cost-outlier funding</i> |
| Austria | No | No | No |
| Catalonia (Spain)* | Yes (for certain high-cost procedures) | No | No |
| England/United Kingdom | Yes (for up to three years) | Yes (for certain high-cost services) | No |
| Estonia | Yes (for certain high-cost services) | No | Yes |
| Finland | Depending on hospital district, both instruments are used | | No |
| France | Yes | Yes | No |
| Germany | Yes | Yes (for certain high-cost services) | No |
| Ireland | Yes | No | No |
| Netherlands | Yes (for certain high-cost drugs) | Yes (envisaged to start in 2011) | No |
| Poland | No | Yes (for certain high-cost services) | No |
| Portugal | No | No | No |
| Sweden | Depending on the county council, all instruments are used | | |

Source: Compiled by the authors on the basis of information presented in the country-specific chapters in Part Two of this volume.

*In Spain hospital financing is decentralized. The information presented here refers to Catalonia, where a DRG system is used that determines 35 per cent of hospital reimbursement.

All extra payments provide strong incentives to hospitals to apply technological innovations, as they exempt the selected technologies from the incentives of DRG-based hospital payment. However, as already mentioned, they may favour the use of certain procedures, drugs or technological equipment over existing technologies included within the DRG-based system, which may reduce efficiency of hospital care (MedPAC, 2001). Furthermore, extra funding may produce 'winners' and 'losers' in the hospital market, as it is likely to lead to higher payments for hospitals that play a strong role in technology dissemination (for example, at university hospitals, at the expense of other hospitals) (MedPac, 2001).

9.3.2 Long-term updating mechanisms in European DRG-based hospital payment systems: Incorporating technological innovations

In terms of incorporating technological innovations into DRG-based hospital payment systems, the processes of updating the PCS and the payment rate are

essential. Table 9.5 presents the frequency of updates and the time-lag to data used for updates in 12 countries across Europe, as these two factors determine how fast a DRG-based hospital payment system is able to respond to technological innovations. Neither of the updating mechanisms are specifically targeted at incorporating technological innovations, but they are intended to

Table 9.5 Frequency of updates and time-lag to data used for updates across 12 European countries

| | <i>DRG-based hospital payment system</i> | | | |
|----------------------------|--|---|---|--------------------------------------|
| | <i>PCS</i> | | <i>Payment rate</i> | |
| | <i>Frequency of updates</i> | <i>Time-lag to data</i> | <i>Frequency of updates</i> | <i>Time-lag to data</i> |
| Austria | Annual | 2–4 years | 4–5 years (updated when necessary) | 2–4 years |
| England/ United Kingdom | Annual | Minor revisions annually; irregular overhauls about every 5–6 years | Annual | 3 years (but adjusted for inflation) |
| Estonia | Irregular (first update after 7 years) | 1–2 years | Annual or following update of fee-for-service fees | 1–2 years |
| Finland | Annual | 1 year | Annual | 0–1 year |
| France | Annual | 1 year | Annual | 2 years |
| Germany | Annual | 2 years | Annual | 2 years |
| Ireland | Every 4 years, linked to Australian updates of AR-DRGs | Not applicable (imported AR-DRGs) | Annual (linked to Australian relative-weight updates) | 1–2 years |
| Netherlands | Irregular | Not standardized | Annual or when considered necessary | 2 years, or based on negotiations |
| Poland | Irregular (planned twice per year) | 1 year | Annual update only of base rate | 1 year |
| Portugal | Irregular | Not applicable (imported AP-DRGs) | Irregular | 2–3 years |
| Spain (Catalonia) | Biennial | Not applicable (imported 3-year-old CMS-DRGs) | Annual | 2–3 years |
| Sweden | Annual | 1–2 years | Annual | 2 years |

Source: Compiled by the authors on the basis of information presented in the country-specific chapters in Part Two of this volume.

ensure that the DRG-based payment systems are always adapted to current practice patterns and treatment costs.

Both the PCS and the payment rate are updated annually in the majority of countries, but there are remarkable exceptions. In 2010, Estonia updated its DRG system for the first time since the introduction of the Nordic PCS (NordDRGs) to the country in 2003. Ireland currently uses Australian Refined (AR-)DRGs, which are updated every four years (see Chapter 15 of this volume). Austria is an interesting outlier with regard to the adjustment of payment rates, as DRG weights are not updated regularly, but are adjusted only for specific DRGs when deemed necessary by policy-makers. The data used for updates vary considerably between countries. In Finland, data are used from the current year to update the DRG system for the next year, and DRG weights are recalculated as soon as data become available (during the same year). In most countries, however, data both for updating the PCS and for adjusting DRG weights or prices are at least two years old.

In addition, the mechanisms to introduce new codes for new procedures, drugs and medical devices affect the way in which DRG systems can incorporate technological innovations. Frequent updates of codes facilitate more rapid adoption and incorporation of technological innovations into DRG systems. Rare updates increase the length of time before technological innovations can be systematically incorporated.

As already mentioned, technological innovations can alter treatment costs in different ways. Countries collecting detailed bottom-up hospital cost-accounting information (see Chapter 5) are clearly in a better position to precisely identify the effect of technological innovations on hospital costs using routinely available information. When technological innovations increase (or decrease) costs for a well-defined subset of patients, adjusting the PCS is the best method of incorporating technological innovations into the DRG-based hospital payment system. However, the incentives to modify the PCS should be closely monitored: if a new DRG is introduced – for example, for using a specific innovative medical device in a broadly defined group of patients – providers could be incentivized to over-provide the technological innovation to patients that would not benefit from the innovative technology.

When technological innovations increase the costs of all services bundled in one DRG or the costs of all hospital services, updates to the payment rate are the best approach to incorporating them into the DRG-based hospital payment system. In order to increase payment for a specific DRG, DRG weights can be recalculated. In order to increase funding for all hospital services, countries not operating a relative-weight approach can inflate raw tariffs by the appropriate amount. Countries using a relative-weight approach have different options. They can either adjust the base rate to account for proportionate increases in costs (for example, a 5 per cent increase of all hospital costs), or they can adjust the base rate and recalculate relative weights if technological innovations increase costs for all cases by a fixed amount.

9.4 Conclusions: Encouraging and incorporating technological innovations in European DRG-based hospital payment systems: Scope for improvement

In many European countries, there are concerns that DRG-based hospital payment systems do not provide the right set of incentives to ensure that patients have timely access to technological innovations. Our discussion of the theoretical incentives of DRG-based hospital payment systems to adopt and use technological innovations in hospitals has revealed that these concerns should be important only for the specific case of those technological innovations that increase quality and are accompanied by a significant increase in total costs per case.

The second part of the chapter illustrates that most (but not all) countries analysed 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, additional payments for technological innovations exempt these technologies from the inherent efficiency incentives of DRG-based hospital payment systems. In fact, generous separate payment methods (such as fee-for-service payments) may lead to a distortion of clinical decision-making and a significant increase in spending on those technological innovations for which separate payments are available (as evidenced in France). Furthermore, as short-term payment incentives are often introduced for technological innovations at a time when rigorous analyses of their (long-term) effects are not yet available, there is a risk that the additional payments inadvertently incentivize the use of cost-increasing technological innovations that are quality neutral or even result in a decrease in the quality of health care.

Therefore, short-term payment instruments should be employed very carefully, and incorporated only after careful assessments have been made concerning the likely effects of the concerned technology on quality of care. In the United States, short-term payment instruments are intended to be limited to technological innovations offering either considerable quality improvements over existing technologies, or offering options for diagnosis or treatment of previously untreatable conditions (Clyde et al., 2008). Unfortunately, in several European countries (such as Germany and France), the introduction of short-term payment instruments for technological innovations seems to be more directly linked to the criteria of higher costs than to the criteria of demonstrating considerable quality improvements.

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 the so-called Coverage with Evidence Development (CED) (Hutton et al., 2007). Under CED approaches, payments for technological innovations are provided only for a limited period of time and on the condition that continuing evaluation is carried out (see Box 9.2 for an example from the Netherlands).

Box 9.2 Coverage with evidence development in the Netherlands

In 2006, new regulations were introduced in the Netherlands regarding expensive (and orphan) inpatient drugs. The regulations specify that an innovative drug can be provisionally included on the expensive (or orphan) drug list(s) for up to four years, which allows hospitals to receive separate payments for these drugs even before their cost-effectiveness has been formally established. The conditions for a drug to be included on a list are that (1) added therapeutic value is demonstrated; (2) a plan for the assessment of cost-effectiveness in daily clinical practice is approved by the pharmaceutical advisory committee; and (3) the drug expenses account for over 0.5 per cent (for the expensive drugs category) or 5 per cent (for orphan drugs) of the annual hospital drug budget. If all three conditions are met, hospitals can receive separate payments amounting to 80 per cent (for expensive drugs) (and 100 per cent for orphan drugs) of the purchase price of drugs placed on the expensive (and orphan) drug list(s). After three years, the data generated in the context of the assessment plan are used to inform decisions about providing further funding for the innovative or (orphan) drug(s).

Source: Delwel, 2008.

Given that most DRG-based hospital payment systems are updated at regular intervals, the change of treatment patterns and costs resulting from the introduction of technological innovations should ultimately be reflected by the DRG-based hospital payment system. Countries with frequent updates of their DRG system and of the payment rate – and with a short time-lag between data collection and using the information collected for DRG-based hospital payment – are clearly in a better position to incorporate technological innovations into their systems. However, if updates of the system lead to the introduction of specific new DRGs for technological innovations (such as drug-eluting stents), the effect may be similar to that of introducing separate payments for technological innovations; namely, introducing strong incentives to make use of the specific technology. More generally, therefore, the issue of incorporating technological innovations into DRG systems highlights the trade-off that exists between providing adequate funding for specific procedures and the intention to promote efficiency by leaving to clinicians the decisions regarding which procedures to use.

Furthermore, in the context of an emerging common European hospital market, there is scope for increasing cooperation across countries in terms of technological innovations. Cooperation appears to be particularly beneficial in the field of assessing the effect of technological innovations on quality. As envisaged by article 15 of the recently adopted European Union (EU) *Directive on the Application of Patients' Rights in Cross-Border Healthcare* (European Parliament and Council, 2011), a European network of health technology assessment (HTA) agencies could assess technological innovations using a common set of criteria

in order to avoid duplication of work and individual analyses in each Member State (Kristensen, 2008). If sufficient evidence is available to demonstrate considerable improvements in quality, decentralized decisions regarding whether or not to introduce short-term payment instruments for these technologies could then be made by governments, self-governing bodies or local payers within Member States, in a manner similar to the decentralized approaches used in Finland, Germany (see Box 9.1) or Sweden. The advantage would be that the available evidence could be assessed more efficiently, while payment decisions would still be made according to national or local value-judgements, which is necessary because differences are likely to exist in the willingness to pay for a given increase in quality.

Empirical research on the effects of DRG-based hospital payment systems in terms of the adoption and diffusion of technological innovations is difficult to design and is relatively scarce. Research relating to the effects of DRG-based payment systems on the adoption, implementation and use of technological innovations has rarely taken into account the different approaches to encouraging and incorporating technological innovations within the family of DRG-based payment systems (Torbica & Cappellaro, 2010; Packer et al., 2006; Bech et al., 2009). Short-term payment instruments and long-term updating mechanisms differ greatly across countries. Future empirical cross-country investigations – for example of the determinants of the implementation and use of technological innovation – should take these differences into account and test empirically whether and how the different identified approaches affect the implementation and use of technological innovation.

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